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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/720,906	11/24/2003	Naiyong Jing	59424US003	5294
32692	7590	04/28/2005	EXAMINER	
3M INNOVATIVE PROPERTIES COMPANY PO BOX 33427 ST. PAUL, MN 55133-3427			WU, IVES J	
			ART UNIT	PAPER NUMBER
			1713	

DATE MAILED: 04/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/720,906

Applicant(s)

JING ET AL.

Examiner

Ives Wu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 March 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-19, 58 and 59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11, 13-15, 58 and 59 is/are rejected.
- 7) ☒ Claim(s) 10, 12 and 16-19 is/are objected to.
- 8) ☒ Claim(s) 20-57, 60-65 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 4-2-2004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-19,58,59, drawn to Method of making a crosslinked fluorinated polymer comprising pending groups and reacted with crosslinking agents, classified in class 525, subclass 326.2.
- II. Claims 20-31,62,63, drawn to Polymer product made of claim 1 composition, classified in class 528, subclass 401.
- III. Claims 32-48,60,61, drawn to Method of self-crosslinked fluorinated polymer with two pending groups to be crosslinked to each other, classified in class 526, subclass 243.
- IV. Claims 49-57,64,65, drawn to polymer product made of claim 32 composition, classified in class 528, subclass 401.

The inventions are distinct, each from the other because of the following reasons:

Inventions Group I and Group II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product can be made by different process or conditions such as different acid functional group or different reducing agent.

Inventions Group III and Group IV are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product can be made by additional crosslink catalyst or by using photo & thermal crosslink process.

Inventions Group I and Group III are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions in Group I is method to cure highly fluorinated single functional group $-\text{SO}_2\text{X}$ polymer by crosslinking agent and Group III is method to crosslink highly fluorinated two functional groups $-\text{SO}_2\text{X}$ and $-\text{Ar}$ polymer by crosslinking with each other (itself) without the crosslinking agent.

Inventions Group I and Group IV are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions in Group I is method to cure highly fluorinated single functional group $-\text{SO}_2\text{X}$ polymer by crosslinking agent and in Group IV is polymer product made of Method disclosed in Group III.

Inventions Group II and Group III are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP §

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808.01). In the instant case the different inventions in Group II is a polymer product made of Method disclosed in Group I and in Group III is method of making two functional groups highly fluorinated polymer by crosslinking itself.

Inventions Group II and Group IV are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case the different inventions in Group II is a polymer product made by method disclosed in Group I and Group IV is another polymer product made by another method disclosed in Group III.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and the search required for Group I is not required for Group II, III, IV, restriction for examination purposes as indicated is proper.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

During a telephone conversation with Attorney Philip Dahl on April 15, 2005 a provisional election was made with traverse to prosecute the invention of Group I, claims 1 - 19, 58,59. Affirmation of this election must be made by applicant in replying

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to this Office action. Claims 20-57, 60-65 withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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(1). Claims 1-9,11,13,14 & 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kerres et al (US20030032739A1) in view of Mao et al (US006090895A), Hedhli et al (US006872781B2).

As to the limitation of **independent claim 1**, it relates to a **method** of making a **crosslinked polymer** comprising the steps: (1). Providing a **highly fluorinated polymer** comprising **pending groups** with formula $-\text{SO}_2\text{X}$, where **X** is independently selected from **F, Cl, Br, I, -OH** or $-\text{O}-\text{SO}_2\text{R}^2$, where **R²** is an **aliphatic group** containing **1-18 carbon atoms** which may be substituted. (2). Reacting said polymer with a **crosslinking agent** according to formula Ar_nR^1 , where **Ar** is selected independent from **aromatic groups** containing **1-18 carbon or nitrogen atoms**, each Ar may be substituted; **R¹** is direct bond or an **aromatic or aliphatic linking group**, where **R¹** may be straight-chain, branched, cyclic, heteroatomic, polymeric, halogenated, **fluorinated or substituted**, **n** is at least **2** to form crosslinks.

Kerres et al (US20030032739A1) **teaches** a **polymer** consists of one or more polymers, which bear the following **functional groups**: $-\text{SO}_2\text{M}$, **M** is **F, Cl, Br, I, OR, NR₂**; **R** is **alkyl, hydroxyalkyl, aryl**; or a precursors of cation exchange groups: $-\text{SO}_2\text{Me}$, where **Me** is **H, Li, Na, K, Cs** or other metal cations or ammonia

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ions; a **crosslinking bridge** $\text{NHR}-(\text{CH}_2)_x\text{-NHR}$ where **R** is **alkyl, hydroxyalkyl, aryl**, Abstract.

Kerres et al (US20030032739A1) **do not teach** the **polymer is highly fluorinated polymer**.

However, Mao et al (US006090895A) **teach** the starting material, including **polymers** containing **pending sulfonic acid** or **carboxylic acid groups**, preferred polymers including in particular **fluorinated polymers** such as **sulfonated poly- α,β,β trifluorostyrene**.

The advantage of using fluorinated polymer material is because perfluorocarbon ionic exchange membrane provides high cation transport, Col. 1 line 18-20; cited in Hedhli et al (US006872781B1).

Therefore, it would have been obvious at the time of applicant's invention to modify Kerres et al (US20030032739A1) teaching of general crosslinked polymer by including Mao et al (US006090895A) teaching of fluorinated polymer because it will achieve the advantages of fast conductivity as mentioned above, motivated by a reasonable expectation of success. In re O 'Farrell, 853 F.2d 894, 903, 7 USPQ2d 1673, 1681 (Fed. Cir. 1988)

With the combination of both teaching, it would provide applicant's invention as addressed in claim 1.

As to **dependent claim 2**, it limits the crosslinks comprising units of **(-SO₂Ar)_nR¹**, Kerres et al (US20030032739A1) disclose a formula of crosslink **polymer - SO₂-NR-(CH₂)_x-NR-SO₂-polymer**, **R = alkyl, hydroxyalkyl, aryl**, abstract

As to **dependent claim 3**, it adds method step c) forming said polymer into a **membrane**, Kerres et al (US20030032739A1) disclose that the formation of the covalent cross-linking bridges takes place during **formation of membrane** when evaporating the solvent by alkylating the sulfonate groups, [0007], line 5-7.

As to **dependent claim 4**, it limits the thickness of membrane to be **less than 90 micron**, Kerres et al (US20030032739A1) disclose the layer distance of phyllosilicates is in general between 10 and 50 angstrom, preferable 13 to 40 angstrom after hydrophobizing, [0071].

As to **dependent claim 5**, it adds method step d) converting any remaining groups **-SO₂X to sulfonic acid group**, Kerres et al (US20030032739A1) disclose during the acidic and/or base and/or neutral aqueous after treatment of the membranes following the membrane formation, the precursors of the cation exchange groups are hydrolyzed to form cation exchange groups, [0007], line 11-14.

As to **dependent claim 6**, it limits each **Ar** is a **phenyl group** which may be substituted, Kerres et al (US20030032739A1) disclose polymer **-SO₂-NR-(CH₂)_x-NR-SO₂-polymer** in which **R is aryl**, Abstract, line 4.

As to **dependent claim 7**, it limits one or more **Ar is substituted with an electron donating group**, Kerres et al (US20030032739A1) disclose **R is Me=H,Li,Na,K,Cs**, Abstract, line 4.

As to **dependent claim 8**, it limits **Ar** is substituted with an **alkoxy group**, Kerres et al (US20030032739A1) disclose **R is -OR** where **R** is **alkyl**, Abstract, line 4.

As to **dependent claim 9**, it limits **R¹** is an **aliphatic linking group** containing **1-20 carbon or oxygen atoms**, Kerres et al (US20030032739A1) disclose **-(CH₂)_x-**, where **x = 3 to 12**, Abstract, line 14.

As to **dependent claim 11**, it limits **n** is **2**, Kerres et al (US20030032739A1) disclose polymer-**SO₂-NR-(CH₂)_x-NR-SO₂**-polymer which is **(-SO₂NR)₂(CH₂)_x** and **n is 2** in this disclosure.

As to **dependent claim 13**, it limits **X** is selected independently from **F or Cl**, Kerres et al (US20030032739A1) disclose precursors of cation exchange groups: **SO₂M** where **M = Hal(F,Cl,Br,I)**, Abstract, line 3,6.

(2). Claims 14,15,58 & 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kerres et al (US20030032739A1) in view of Mao et al

(US006090895), Hedhli et al (US006872781B2) and further in view of Yang (US20040241518A1).

As to the limitations of **dependent claims 14 & 15**, it limits the pending groups to sulfonated fluoroether groups.

Kerres et al (US20030032739A1) **teach** the general formula of pending ether group **-OR** where R = alkyl, hydroxyalkyl, aryl only.

Kerres et al (US20030032739A1) and Mao et al (US006090895), Hedhli et al (US006872781B2) **do not teach** the fluorinated pending groups to be **-O-(CF₂)₄-SO₂X** or **-O-CF₂-CF(CF₃)-O-CF₂-CF₂-SO₂X**.

However, Yang (US20040241518A1) **teaches** fluorinated ionomer comprises at least 6 mole % of monomer units having a fluorinated pendant group with a terminal ionic group, Abstract, line 5-7; **-O-(CF₂)₂-SO₃H** & **-O-CF₂-CF(CF₃)-O-CF₂-CF₂-SO₃H**, page 10, line 9,12.

The advantage of selecting fluorinated pending groups as pending groups is to reduce methanol cross-over in ionomeric membranes while entailing as small as possible cost in conductivity, [0006].

It would have been obvious at the time of applicant's invention to modify Kerres et al (US20030032739A1) teachings of **-O-R** ether group by including Yang (US20040241518A1) teaching of fluorinated pending groups because it will improve the efficiency of fuel cell, [0005].

With combination of three teaching, it would provide applicant's invention as addressed in claims 14 & 15.

As to the limitations of **dependent claims 58 & 59**, it add to method step c) imbibing mixture into a **porous supporting matrix** and supporting matrix is a **porous polytetrafluoroethylene web**.

Kerres et al (US20030032739A1) and Mao et al (US006090895), Hedhli et al (US006872781B2) **do not teach** the porous supporting matrix which is made from polytetrafluoroethylene.

However, Yang (US20040241518A1) **teaches** the membrane may optionally include a **porous support** for the purpose of improving mechanical properties [0047], line 1-3; For example, the polymer for the porous support can be a **microporous film of polytetrafluoroethylene (PTFE)**, [0048].

The advantage of using porous support matrix is to improve mechanical properties, for decreasing cost and/or other reasons, [0047], line 1-3; Polytetrafluoroethylene is used for reason of its resistance to thermal and chemical degradation, [0047], line 9-10.

It would have been obvious at the time of applicant's invention to modify Kerres et al (US20030032739A1) teachings of crosslinked polymers via sulfinate alkylation and Mao et al (US006090895A) teaching of fluoropolymer as backbone by including Yang

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(US20040241518A1) teaching of using porous supporting matrix made from polytetrafluoroethylene because it will improve the membrane as mentioned above.

With combination of three teaching, it would provide applicant's invention as addressed in claims 58 & 59.

Allowable Subject Matter

Claims 10,12,16,17,18,19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims because the disclosure of these dependent claims overcome the prior art.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ives Wu whose telephone number is 571-272-1114.

The examiner can normally be reached on 8:00 - 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu can be reached on 571-272-1114. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Examiner: Ives Wu

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SUPERVISORY PATENT EXAMINER
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